

NATIONAL HARMFUL ALGAL BLOOM (HAB) FORECAST SYSTEM GULF OF MEXICO

Overview:

- Twice weekly bulletins issued during active HABs, once weekly during inactive periods year-round, with supplemental bulletins issued as necessary
- Bulletins issued to coastal resource managers, state and federal officials, and academic and research institutions
- Publicly available coastal impact report for the next 3-4 days, posted through CO-OPS:
<http://tidesandcurrents.noaa.gov/hab>
- Team of seven rotating forecasters; one forecaster is on call for each forecast region during business hours (see Figure 1 below for forecast regions)
- One central telephone number and email distribution address
- Education and outreach response to general public information requests
- Annual forecast skill assessment

Status:

- Eastern Gulf of Mexico (Western Florida) operational October 1, 2004; region expanded to include East Florida coast in 2010. Region shown in yellow in Figure 1 below.
- Western Gulf of Mexico (Texas) operational September 30, 2010. Region shown in blue in Figure 1 below.

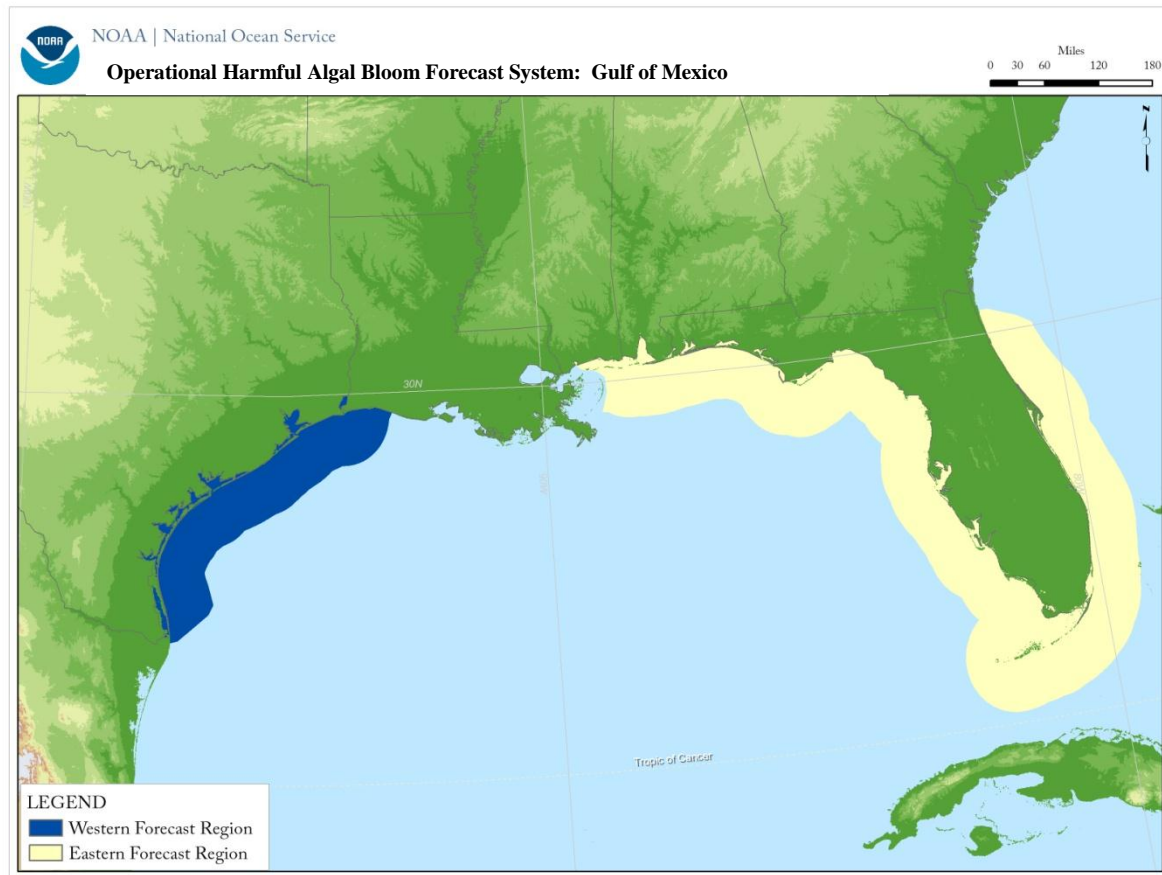


Figure 1. Delineation of NOAA's HAB Operational Forecast System (HAB-OFS) regions.

Methodology:

The HAB Bulletin is developed through expert analysis and integration of region specific oceanographic, meteorological, biological, and public health observations and forecast data. A particle transport model is also used to develop transport forecasts for the western Gulf of Mexico only. A region-specific operational software system housed at CO-OPS processes chlorophyll imagery, wind data, and HAB samples for display with the supporting scientific analysis and forecasts on the Bulletins.

Data Sources:

- MODIS satellite ocean color imagery through NOAA's CoastWatch Program (NESDIS)
- NWS meteorological observations and marine forecasts
- NAM wind models
- *In situ* biological sample data
- *In situ* current meter data
- Public and animal health data (respiratory irritation reports from Mote Marine Lab and dead fish, etc. reports from several sources)
- Wind-driven transport tool developed by NCCOS
- Modeled and observed currents manually downloaded from the Texas General Land Office's Automated Buoy System website (<http://tabs-os.gerg.tamu.edu/tglo/>)
- *In situ* optical data from AUV's and moored sensors (Brevebuster data as available through Mote Marine Lab, FlowCytobot data reported by the TX Parks and Wildlife Department)

Output:

- Current bloom conditions and location
- Potential for HAB development
- Bloom transport forecast
- *Karenia brevis* intensification forecast
- Change in bloom extent forecast
- Daily coastal impact forecasts

Management Action Supported by Forecasts:

- Prompts early response for shellfish monitoring and closure of shellfish beds by coastal managers for the prevention of public shellfish poisoning (Agencies: FL Dept. of Agriculture and Consumer Services (FDACS), TX Dept. of State Health Services (DSHS), etc.)
- Provides bloom location and transport information allowing for aquaculturists to reposition or harvest shellfish prior to bloom appearance (Agencies: FDACS Division of Aquaculture, TX Parks and Wildlife Dept. (TPWD), etc.)
- Provides guidance to coastal managers who regulate public beach warnings/closures (Agencies: Collier County Health Department (CCHD), local health departments under the FL Dept. of Health, etc.)
- Initiates *in situ* monitoring response by coastal managers (Agencies: FL Fish and Wildlife Research Institute (FWRI), Mote Marine Lab (MML), TPWD, etc.)
- Provides public with daily HAB-related respiratory distress guidance along the coast; public can use guidance to alter travel plans when necessary

NOAA Partners	Role in Operational HAB Forecasting
NOAA/Center for Operational Oceanographic Products and Services (CO-OPS)	Analysis and Forecast generation; Operational bulletin dissemination; Public inquiry response; Forecast assessment; User training and continual user requirements gathering
NOAA/National Centers for Coastal Ocean Science (NCCOS)	Research and product development (including biology of <i>Karenia brevis</i> and development of chlorophyll algorithms for satellite imagery), Initial user needs and forecast requirements gathering
NOAA's Coastwatch	Processing and provision of satellite data
National Weather Service	Marine meteorological observations, forecasts, and wind models

Primary Role of Local Partners, Managers and the Public in Forecasting and Validation:

Partner	Role in Forecasting
Local Partners:	Provider of <i>in situ</i> sampling, bloom confirmation, and public health impact data
Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute	<i>in situ</i> sampling, dead fish (animal health reports) and discolored water reports
Mote Marine Laboratory	<i>in situ</i> sampling, optical sensor for <i>K. brevis</i> similarity indexes (BreveBuster glider)
Mote Marine Laboratory's Environmental Health Program	public respiratory health reports
Sarasota County Health Department	<i>in situ</i> sampling
Collier County Pollution Control & Prevention Department	<i>in situ</i> sampling, dead fish (animal health reports) and discolored water reports
Alabama Department of Public Health, Mobile Division Laboratory	<i>in situ</i> sampling
Texas Parks and Wildlife Department	<i>in situ</i> sampling, dead fish (animal health reports) and discolored water reports, optical sensor
Texas Department of State Health Services	<i>in situ</i> sampling, dead fish (animal health reports) and discolored water reports
Coastal and Resource Managers (those not already listed as local partners)	Provider of public and animal health data for forecast validation
General Public	Provider of public health data for forecast validation

Forecast and Forecast Validation Limitations:

- Satellite imagery has insufficient resolution at the coast for the Gulf of Mexico.
- Ad hoc *in situ* observations of water samples and HAB aerosols lack dense spatial and temporal coverage and are insufficient to enhance the satellite data:
 - Limiting improvement of forecast quality and resolution.
 - Hindering blooms validation (for events detected by satellite imagery).
- Cloudy satellite imagery can hinder detection of blooms.
- Prolonged periods of HAB activity can disrupt the chlorophyll imagery algorithm used for detection.
- HAB forecast accuracy relies upon the validity of oceanographic and meteorological model guidance (e.g. forecasted winds, currents, etc.). Modeled currents must be adjusted against measured currents.

Current Sponsored Research to Inform the Gulf Forecast System:

Program	Project	PIs	Institutions	Project Period
ECOHAB	Karenia Nutrient Dynamics in the Eastern Gulf of Mexico	C.A. Heil (lead), D. Bronk, L.K. Dixon, G. Hitchcock, G. Kirkpatrick, M. Mulholland, J. O'Neil, J.J. Walsh, R. Weisberg	Florida Fish & Wildlife Conservation Comm. (lead), Univ. of Miami, Mote Marine Lab, Old Dominion Univ., Univ. of Maryland, Univ. of South Florida	FY06-FY10
ECOHAB	Mechanism of Harmful Algal Bloom Initiation in the Western Gulf of Mexico	L. Campbell (lead), R. Hetland, R. Stumpf, R. Olson, H. Sosik	Texas A&M Univ. (lead), WHOI, NOS/NCCOS	FY09-FY12
MERHAB	Comparative Analysis of Quantitative Detection Methods of Enumeration of HAB Species: Applications for Resource Management (partial research related to Gulf of Mexico - Alabama)	D. Greenfield (lead), K. Coyne	Univ. of South Carolina (lead), Univ. of Delaware	FY10-FY13

Bulletin Recipients (by agency and primary role):

Federal Agencies

EPA - Gulf Breeze Laboratory and Gulf of Mexico Program
FEMA
NASA
National Park Service
NOAA
U.S. Army Corps of Engineers
U.S. Department of Agriculture
U.S. Fish and Wildlife Service
U.S. Geological Survey

State and Local Agencies: Coastal and Resource Management, Public Health

Alabama Department of Environmental Management
Alabama Department of Health
Center for Disease Control – Nat'l Center for Environmental Health
Charlotte Harbor National Estuary Program
City of Naples, Natural Resources
Collier County Government, Florida
Department of Community Development, Town of Fort Myers Beach
Everglades and Dry Tortugas National Parks (NPS)
Florida Department of Agriculture and Consumer Services
Florida Department of Environmental Protection

State and Local Agencies: Coastal and Resource Management, Public Health (cont.)

Florida Department of Health - Bureau of Community
Environmental Health
Florida Department of Health - Epidemiology and Communicable
Disease Control Service
Georgia Division of Public Health
Lee County Div. of Natural Resources
Louisiana Department of Environmental Quality
Louisiana Department of Health and Hospitals
Manatee County Environmental Management
Marine Mammal Stranding and Response Network
Mexico - SEMARNAT
Mississippi Department of Marine Resources
Rookery Bay Nat'l Estuarine Research Reserve
Sarasota County Government, Water Resources Dept.
Sarasota County Health Department
South Carolina Dept. Health and Environmental Control
South Florida Water Management District
South West Florida Watershed Council
Texas Department of Health Services
Texas Parks and Wildlife Department

HAB Research and Academia

Florida Bay Interagency Science Center, Everglades National Park
Florida Environmental Research Institute
Florida Fish and Wildlife Conservation Commission
Mote Marine Laboratory
Old Dominion University
Pacific Northwest National Laboratory
Rosenstiel School of Marine and Atmospheric Sciences
Sanibel-Captiva Conservation Foundation
Smithsonian Environmental Research Center
Texas A&M University
Texas Veterinary Medical Diagnostic Lab - Texas A&M
University of Florida
University of Southern Mississippi
University of Texas

Conservation and Education

Earthfriends
Emerald Coast Wildlife Refuge
Sarasota Bay National Estuary Program

Recreation, Planning, and Awareness

Dade County Skywarn
Emerald Coast Convention and Visitors Bureau, Inc.
Longboat Key Beach Re-nourishment Project
Padre Island National Seashore
Sarasota County Environmental Services
Texas General Land Office